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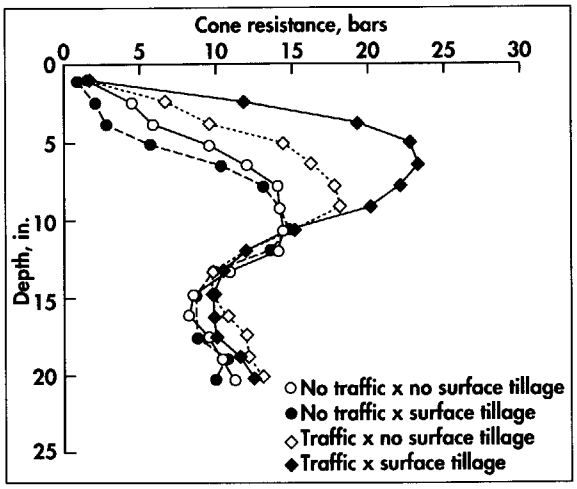
TRAFFIC AND TILLAGE: MANAGING SOIL COMPACTION FOR CORN

EQUIPMENT traffic after intensive tillage severely compacts soil, but corn plants have the ability to compensate for reduced rooting in compacted soil zones, according to findings in a cooperative project by the Alabama Agricultural Experiment Station and the USDA-Agricultural Research Service (ARS).

This ongoing study, which is being conducted at the E.V. Smith Research Center, Shorter, was initiated in 1988 on a Norfolk loamy sand with a well developed hardpan 6 to 10 in. below the surface. A winter cover crop of Cahaba White vetch was planted in the fall of 1987 and 1988. The cover crop was killed with Gramoxone® 4 to 7 days prior to planting DeKalb 689 corn in 30 in. rows each spring.

All possible combinations of three factors were included in the study. The three factors were:

- Deep Tillage: (1) no subsoiling, (2) annual in-row subsoiling, or (3) complete disruption of the hardpan, subsoiling on 10-in. centers,
- Surface Tillage: (1) incorporating the cover crop residue by disking and field cultivating, or (2) leaving the cover crop residue in place on the soil surface,
- Equipment Traffic: (1) normal traffic with the use of 4-row equipment, or (2) no traffic using a wide-frame research vehicle.



Soil strength as affected by traffic and tillage within a wheeled or tire middle.

In 1989, soil moisture was monitored from tasseling until black layer in three positions; in the row, and in the middles on either side of the row. In plots that received traffic, with the four-row pattern, every other row middle would have been compacted by tractor tires.

Soil water was highest in the traffic or tire middles, especially with surface tillage, table 1. This shows that soil compaction in the wheel tracks, especially following surface tillage, reduced root growth and subsequent soil water extraction.

TABLE 1. VOLUMETRIC SOIL WATER CONTENT IN 0-8 IN. DEPTH AS INFLUENCED BY TRAFFIC, TILLAGE, AND ROW POSITION

Traffic	Tire middle		No-tire middle	
	Surface tillage	No-surface tillage	Surface tillage	No-surface tillage
	Pct.	*Pct.*	*Pct.*	*Pct.*
No-traffic	10.95	11.98	11.01	11.55
Traffic	15.01	13.97	10.23	12.48

TABLE 2. INFLUENCE OF DEEP AND SURFACE TILLAGE ON CORN GRAIN YIELD

Deep tillage	Surface tillage, 1988, bu./acre		Surface tillage, 1989, bu./acre	
	Yes	No	Yes	No
No subsoiling	23	18	103	75
Annual subsoiling	44	50	113	110
Complete disruption	56	61	124	118

Without traffic, surface tillage increased soil water extraction, resulting in lower soil water contents, however, there were no differences due to row middle position since in these plots neither middle was compacted by equipment tires. In trafficked plots, soil water content was much less in the no-tire middles than the tire middles, indicating greater root growth and water extraction in the no-tire middles of these plots.

Soil strength measurements with a penetrometer show that traffic after surface tillage severely recompacts the soil, see figure. In contrast, the increased bearing capacity of no-till (no surface tillage) resulted in reductions in traffic-induced compaction of up to one half that found following disking and field cultivation.

Although penetrometer and soil water data confirm the detrimental effect of traffic after intensive tillage, there were no yield differences as a result of traffic. This, along with water use patterns, table 1, indicates that corn compensated for reduced rooting in wheeled or tire middles by increased rooting in nonwheeled or no-tire middles.

In both the drought year of 1988 and the abundant rainfall year of 1989, surface tillage interacted with deep tillage to affect grain yields, table 2.

In the drought year of 1988, with both complete disruption and in-row subsoiling, yields were greatest when vetch residue was not incorporated by surface tillage. Without deep tillage, however, surface tillage increased yields. With favorable rainfall in 1989, there was no benefit from leaving residues on the surface, as in 1988. However, yields again increased with the intensity of deep tillage while surface tillage increased yields when no deep tillage was performed.

Results suggest that the conservation tillage practice of in-row subsoiling without incorporating residues is an appropriate practice for sustaining crop yields on Coastal Plain soils, especially if traffic patterns can be maintained so that at least one row middle adjacent to each row receives no traffic during the growing season.

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